



IOT & MACHINE LEARNING IN THE DEVELOPING WORLD

AN INTERVIEW WITH MARCO ZENNARO

Marco Zennaro is a research scientist at the Abdus Salam International Centre for Theoretical Physics in Trieste, Italy, where he coordinates the Science, Technology & Innovation Unit.

Marco's research interest is in ICT4D (information and communication technology for development), the use of ICT for development, and in particular he investigates the use of Internet of Things for Development (#IoT4D). He is a Visiting Professor at Kobe Institute of Computing (KIC) in Kobe, Japan, and is the TinyML4D Chair and Academic Network Co-Chair of the [TinyMLedu initiative](#).

We were lucky enough to catch up with Marco for a chat about his research and the Internet of Things, and in particular how the IoT can play a critical role in addressing the challenges of major world issues, such as poverty, lack of access to education, clean water and sanitation, and environmental degradation. (To go more in-depth, [listen to our podcast with Marco](#).)

[Arduino Education](#): Hi Marco, it's good to chat! Can we start today by asking you what gets you inspired?

[Marco Zennaro](#): I feel inspired when I see the output of my teaching. When I teach something, and then I see that students pick up what I teach and they expand it in their own environment.

[AE](#): That's really cool. And what about your research - what is the Abu Salam International Center of Theoretical Physics? What did you do there? What is the mission?

[MZ](#): The center opened about six years ago by a physicist called Abu Salam from Pakistan. He later received a Nobel Prize for supporting science in developing countries. And that's what we've been doing for six years. We do it in different ways. For example, we invite people on training courses, to conferences, or even for longer stays, and we organize



activities in developing countries itself. We are also a Category One UNESCO Institution, which means that we're part of the UN family at large.

AE: Amazing! And your research focuses on IoT wireless sensor networks and their application in developing countries. Can you tell us more about that?

MZ: The basic idea is that networks and IoT have a very broad range of applications, and these applications are even more interesting in developing countries than in developed countries. Because there are many things to be measured, and most of these countries are data poor.

There are many applications, as you know. I would say that the environment is maybe number one. So if you're thinking about climate change, for example, we need to have data about climate.

There's this number that always strikes me: there are the same number of weather stations on the continent of Africa as there are in Germany. The issue is that weather stations are very expensive devices, and they need maintenance, and they need to be constantly connected to the internet to send data. So the question is, can you use IoT devices to measure climate and weather conditions in a low cost, low power way, so that they can work properly in a more difficult environment?

AE: That's so interesting. Do you have other examples of IoT deployment? And during your research, what challenges have you encountered?

MZ: The main challenge is getting access to IoT devices, especially when we're talking about radio devices. The other issue is data. We use cloud services, but not all countries allow that - especially when you're dealing with sensitive data. The third challenge is an ethical one. For example, there were situations where workers were worried about their job because of the IoT automating everything.

AE: And can you tell us a bit about your work in particular countries?

MZ: Yes - in Uganda and Rwanda, for example, I've been running hands-on training courses for faculty members and universities, with the aim of increasing awareness of IoT. We've measured air quality in Benin and South Africa, landslides in Ecuador, and water volumes in Malawi.

AE: And how do you see this evolving in the future?

MZ: Well, there's a big interest in machine learning (ML), and having machine learning on small devices. That has, I think, huge potential in developing countries. It's lower cost than IoT, because we're using microcontrollers versus micro processors, and lower power. We've actually built an academic network of people who are interested in ML, and we're going to run workshops.

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